

ASAS Western Section Graduate Paper Competition

8 Feedlot performance and carcass quality of conventionally raised lambs implanted with zeranol versus naturally raised lambs. S. R. Eckerman^{*1,2}, G. P. Lardy¹, M. M. Thompson², B. W. Neville¹, M. L. Van Emon^{1,2}, P. T. Berg¹, and C. S. Schauer², ¹North Dakota State University, Department of Animal Sciences, Fargo, ²Hettinger Research Extension Center, Hettinger, ND.

Our objectives were to compare feedlot performance and carcass quality of conventional and naturally raised lambs. Two-hundred 88 crossbred lambs (34 ± 0.1 kg) were assigned randomly to one of 12 pens (6 pens/treatment) and fed a finishing ration for 112 d. Treatments were conventional (CONV) or naturally raised (NAT). Naturally raised lambs were fed 80% corn and 20% commercial supplement ad libitum (DM basis; 87.9% TDN and 15.8% CP) with decoquinatate included. The NR lambs were not treated with antibiotics nor given growth promoting implants. Conventional lambs were fed a similar ration, with decoquinatate, chlortetracycline and lasalocid included in the ration and were implanted with 36 mg zeranol on d 28 and treated with antibiotics as necessary, primarily for treatment of prolapse. Lambs were weighed and feed refusals collected every 28 d. Lambs were harvested on d 117 and carcass data collected 24 h post chill. Data were analyzed using the mixed procedures of SAS. Repeated measures was used to analyze period effects for ADG, DMI, and G:F. Treatment x period interactions were observed for ADG, DMI, and G:F ($P < 0.01$). From d 29 to 56, CONV lambs had increased ADG, DMI, and G:F ($P \leq 0.01$) compared with NAT lambs. However, ADG, DMI, and G:F were not different between treatments ($P \geq 0.06$) for d 0 to 112. Naturally raised lambs had greater rib eye area ($P = 0.03$), decreased body wall thickness ($P = 0.05$), and a greater percentage boneless, closely trimmed retail cuts ($P = 0.05$). More CONV lambs prolapsed rectally or vaginally ($P = 0.001$; 8.3 vs 0%) which increased mortality ($P = 0.01$; 2.8 vs 0%). Lambs managed utilizing antibiotics, implants, and ionophores may have increased growth performance compared with lambs raised naturally, but may have diminished carcass quality and are more susceptible to prolapse and mortality.

Key Words: lamb, zeranol, naturally raised

9 Effects of rumen protected arginine supplementation on ewe serum amino acid concentration, circulating progesterone, and ovarian blood flow. C. S. Saevre^{*1,2}, J. S. Caton¹, J. S. Luther³, A. M. Meyer¹, D. V. Dhuyvetter⁴, R. Musser⁵, J. D. Kirsch¹, M. Kapphahn¹, D. A. Redmer¹, and C. S. Schauer², ¹Department of Animal Sciences, North Dakota State University, Fargo, ²Hettinger Research Extension Center, North Dakota State University, Hettinger, ³University of Wisconsin River Falls, River Falls, ⁴Ridley Block Operations, Mankato, MN, ⁵SODA Feed Ingredients, LLC, Mankato, MN.

Objectives were to determine if rumen-protected arginine supplemented to ewes on d 8 to 13 of the estrous cycle affected serum amino acid concentration, ovarian blood flow, and circulating progesterone. Nineteen multiparous Dorset ewes (63.8 ± 1.1 kg initial BW) were individually housed and randomly allocated to 1 of 4 rumen-protected arginine treatments: 0 (CON, $n = 5$), 90 (90 ARG, $n = 4$), 180 (180 ARG, $n = 5$), or 360 mg/kg BW supplemental arginine (360 ARG, $n = 5$). Following estrous synchronization, ewes were individually fed rumen-protected arginine blended into 150 g ground corn, which was immediately followed with 650 g of a pelleted diet (2.40 Mcal ME/kg and 12.9% CP, DM basis) on d 8 to 13 of the estrous cycle. Jugular blood samples were taken for amino acid and progesterone analysis. On d 12, color Doppler

ultrasonography was used to determine ovarian hemodynamics. Ewes fed 360 ARG had greater serum arginine concentration than CON, 90 ARG, and 180 ARG on d 11 (175.5 vs. 153.2, 132.3, and 145.4 \pm 8.6 nmol/mL, respectively; $P = 0.01$) and d 12 (166.4 vs. 142.7, 121.7, and 128.2 \pm 7.4 nmol/mL, respectively; $P = 0.002$). On d 11, arginine as a percent of total amino acid concentration was increased in 360 ARG compared with CON and 90 ARG (7.16 vs. 6.19, 5.70 \pm 0.34 nmol/mL, respectively; $P = 0.04$). Total essential amino acid concentration was elevated in 360 ARG compared with 90 ARG and 180 ARG ($P = 0.08$) on d 12. Arginine supplementation increased peak systolic velocity in the corpus luteum for 360 ARG and 90 ARG compared with CON (30.53 and 32.59 vs. 22.63 \pm 2.48 cm/s, respectively; $P < 0.07$). Flow time (milliseconds) in the ovarian hilus and corpus luteum was increased in 360 ARG compared with all other treatments ($P \leq 0.02$ and $P \leq 0.06$, respectively). Supplemental rumen-protected arginine had no effect on serum concentration of progesterone ($P > 0.50$). Results indicate that rumen-protected arginine supplemented to ewes at the rate of 360 mg/kg BW may increase circulating serum arginine concentration, in addition to increasing ovarian blood flow.

Key Words: arginine, ovarian hemodynamics, sheep

10 Effect of wet distillers grains with solubles on rumen bacterial community profiles in individually fed cattle. L. N. Tracey^{*1}, J. Browne-Silva¹, C. H. Ponce², J. B. Osterstock³, J. C. MacDonald^{2,3}, M. Brown^{2,3}, and S. L. Lodge-Ivey¹, ¹New Mexico State University, Las Cruces, ²West Texas A&M, Canyon, ³Texas AgriLife Research, Amarillo.

Despite the growing use of wet distillers grains with solubles (WDGS) in the US, very few data are available that describe potential rumen fermentation and microbial ecology alterations that may occur by feeding higher concentrations of WDGS. The objective of this experiment was to evaluate the effects of WDGS on ruminal bacterial communities. Twenty-three steers that had been acclimated to steam-flaked corn finishing ration (average BW = 340 \pm 29.6 kg) were randomized and assigned to one of 3 treatment groups. Cattle were individually fed via calan gates once per day. Treatments were replacement of steam-flaked corn with 0, 30, or 60% WDGS (DM basis; $n = 7, 8,$ and $8,$ respectively). Ruminal fluid was collected once per wk for 5 wk via esophageal tubing before feeding. Samples were frozen and stored at -20°C for further analysis. Ruminal fluid community DNA and 16S rDNA was amplified and analyzed by denaturing gradient gel electrophoresis (DGGE). Clustering of DGGE banding patterns was normalized to an external standard and compared based on binary and numerical coefficients of Dice and Pearson, respectively. Binary banding patterns for all samples were 59.8% similar and total number of bands per sample was not influenced by treatment ($P = 0.96$). Analysis of treatment dendrograms for binary banding pattern revealed a decrease in similarity from 30 to 60% WDGS, with 0% being intermediate (68.5, 71.2, and 59.2 \pm 7.09% for 0, 30, and 60% WDGS, respectively). Banding pattern similarity decreased during the duration of the experiment (73.4, 80.4, 72.8, 60.0, and 61.9 \pm 8.65% for wk 1–5, respectively). Construction of dendrograms based on band intensity resulted in a dramatic reduction (19.2 \pm 12.32%) of similarity across treatments. These results indicate feeding high levels of WDGS does not decrease the richness of the bacterial population but shifts in individual bacterial community members do occur.

Key Words: wet distillers grains with solubles, cattle, bacteria

11 Forage selection preferences by multiparous and primiparous beef cows grazing native tallgrass range during winter. N. A. Sproul,* L. W. Murray, J. R. Jaeger, D. A. Blasi, L. N. Edwards, G. J. Eckerle, L. A. Pacheco, and K. C. Olson, *Kansas State University, Manhattan.*

Our objective was to evaluate diet selection preferences of 18 experienced multiparous and 20 naive primiparous beef cows (9 and 2 yr old, respectively) grazing dormant, native tallgrass pastures during winter. The study was analyzed as a 4-period, 8-pasture (average size = 28 ha) Latin rectangle. Predominant pasture forage species were *Andropogon gerardii* and *Schizachyrium scoparium*, which were grouped together for analysis (BL); *Bouteloua curtipendula* (SO); *Bouteloua gracillis*, (BG); *Panicum virgatum* (SG); *Sorghastrum nutans* (IG); *Amorpha canescens* (LP); *Symphytichum ericoides* (HA); *Liatris punctata* (DG); and *Dalea purpurea* (PP). Animals were grouped randomly by parity status (n = 4 or 5) and grazed 1 of 4 assigned pastures during 4 consecutive 48-h periods. Fecal samples were collected from each animal at the end of each period. Range-plant fragments in fecal samples were quantified using a modified microhistological technique; plant fragment prevalence in fecal material was assumed to be equivalent to diet composition on a DM basis. Primiparous cows selected more forbs and fewer grasses (main effect of parity; $P = 0.09$) than multiparous cows. Multiparous cows ate more ($P = 0.07$) BL and less DG ($P = 0.05$) than primiparous cows. Consumption of all forbs, PP, LP, and DG by both classes of cows declined ($P \leq 0.04$) over time, while consumption of all grasses, BL, and BG increased over time ($P \leq 0.02$), possibly indicating that forb availability diminished over time. Occasional differences in consumption of IG, SG, SO, and HA between primiparous and multiparous cows occurred; however, differences were inconsistent (parity \times period effect; $P \leq 0.02$) over time. Differences in diet selection patterns between multiparous and primiparous cows during a short-term winter grazing period could be indicative of differences in long-term foraging strategies. We interpreted these data to suggest that foraging strategies associated with cow stayability may be related to selection preferences during periods of poor forage quality.

Key Words: botanical composition, beef cows, grazing

12 Dry matter intake is repeatable over parities and residual feed intake is negatively correlated with dry matter digestibility in gestating cows. T. J. McDonald,* B. M. Nichols, M. M. Harbac, T. M. Norvell, and J. A. Paterson, *Montana State University, Bozeman.*

Feed costs account for approximately two-thirds of total cash inputs for cow/calf producers. Selecting cows that consume less DM, but maintain production, would lower breakeven costs. The objectives of these 2 experiments were to determine repeatability of DMI over parities, calculate residual feed intake (RFI), and examine the relationships between RFI and diet DM digestibility. Nichols et al. (2010, these proceedings) previously determined individual DMI for 120 gestating, primiparous heifers in 2008. Twenty-four of these heifers that had the highest and lowest DMI were selected for this 2009 experiment. Cows (3-yr-old, BW = 593 ± 50 kg, second trimester gestation) were fed a diet composed of 74% grass hay and 26% grain-based supplement (104% of MP requirement) to determine the correlation of DMI per BW^{0.75} between 2008 and 2009 when cows were in a similar gestational state. Diets were limit fed at 12.7 kg DM•cow⁻¹•d⁻¹ using a GrowSafe system. Cows were adapted to the diet for 10 d, followed by a 70-d trial to determine individual feed intakes and weight gain. Residual feed intake was calculated as the residual from the linear regression of DMI on BW^{0.75} and ADG. Dry matter intake per BW^{0.75} was highly correlated ($r = 0.71$, $P < 0.01$) between first and second parities. Residual feed intake ranged from 4.46 kg/d to -4.58 kg/d. Immediately following Exp. 1, cows were fed for

an additional 5 d for collection of feces (Exp. 2). Grab samples were collected daily at 0600 and 1800, and indigestible ADF was used to estimate DM digestibility. Residual feed intake was negatively correlated with DM digestibility ($r = -0.51$, $P = 0.03$, range = 62.6% to 74.2%) but had no relationship with digestible DMI ($P = 0.32$). Results showed that DM intakes were repeatable over parities, and as RFI increased, DM digestibility of a forage-based diet decreased.

Key Words: residual feed intake, gestation, digestibility

13 The relative importance of weaning management and vaccination history on performance by ranch-direct beef calves during weaning and receiving. M. J. Macek*¹, J. W. Illiff¹, K. C. Olson¹, J. R. Jaeger², T. B. Schmidt³, D. U. Thomson¹, and L. A. Pacheco¹, ¹*Kansas State University, Manhattan*, ²*Western Kansas Agricultural Research Center, Hays*, ³*Mississippi State University, Starkville.*

Angus \times Hereford calves (n = 437; average initial BW = 208 ± 25 kg) were stratified by BW, sex, and age and assigned randomly to 1 of 3 treatments that corresponded to length of time between weaning and shipping to a feedlot: 45, 15 or 0 d. Within each weaning period length, calves were assigned randomly to 1 of 2 bovine respiratory disease (BRD)-vaccination treatments: vaccinated 14 d before weaning and again at weaning (PRE) or vaccinated on the d of arrival at the feedlot and again 14 d later (POST). On a common shipping date, calves were transported 3 h to an auction market and held for 12 h. Calves were then transported 1 h to a feedlot. Calves were fed the same diets ad libitum throughout the study. Incidence of undifferentiated fever 15 d after weaning was greater ($P < 0.01$) for calves weaned 45 d before shipping than for calves weaned 15 d before shipping; however, ADG before shipping was greater ($P < 0.01$) for calves weaned 45 d than those weaned 15 d. Incidence of undifferentiated fever and ADG before shipping were similar ($P > 0.66$) between PRE and POST. Average DMI before shipping by 45-d calves was less ($P < 0.01$) than that by 15-d calves. Also, DMI by PRE calves was less ($P = 0.03$) than that by POST calves. Incidence of undifferentiated fever during receiving was similar ($P \geq 0.73$) between weaning and vaccination treatments. Calf ADG during receiving tended to be greater ($P < 0.07$) for 45- and 15-d calves than for 0-d calves. Receiving DMI increased ($P < 0.01$) as number of d between weaning and shipping increased. Conversely, the timing of vaccination did not affect ($P \geq 0.51$) ADG or DMI during receiving. Growth efficiency was similar ($P \geq 0.36$) among weaning and vaccination treatments. Weaning more than 15 d before shipping did not improve health or growth of cattle that were moved from their ranch of origin to a feedlot within 16 h and were not commingled with market-sourced cattle. Pre-shipment BRD vaccination may not change health or performance of ranch-direct cattle relative to BRD vaccination deferred until feedlot arrival.

Key Words: health, preconditioning, weaning

14 Effects of sun-curing and harvest maturity on concentration and protein-binding capacity of condensed tannins in sericea lespedeza (*Lespedeza cuneata*). G. J. Eckerle*¹, K. C. Olson¹, J. R. Jaeger², J. L. Davidson³, T. K. Kraft¹, and L. A. Pacheco¹, ¹*Kansas State University, Manhattan*, ²*Western Kansas Agricultural Research Center, Hays*, ³*Greenwood County Extension, Eureka, KS.*

A study was conducted to evaluate the effects of sun-curing and harvest maturity on concentrations of condensed tannins (CT) and protein-precipitable phenolics (PPP) in sericea lespedeza (SL). Samples of SL (n = 200 plants/sample) were collected from a single native tallgrass pasture at 1 to 4-wk intervals from June 24 to October 11 that corresponded to

single-stem, branched-stem, budding, flowering, and senescent stages of plant phenology. Samples were divided randomly into 2 equal portions that were either dried via sun-curing or were frozen immediately after harvest and later freeze-dried. Total phenolics were extracted from dried, ground SL samples using a modified methanol-extraction technique and were analyzed for CT and PPP. Concentrations of CT in sun-cured SL were less (main effect of treatment, $P < 0.01$) than that in fresh SL. Concentration of CT in SL responded cubically ($P < 0.01$) over time; CT was least during June and October and peaked from late July to mid September. Peak CT concentration corresponded to the budding and flowering stages of the SL life cycle. Concentrations of PPP in SL also changed over time but the magnitude of the effect was influenced by treatment (treatment \times period, $P < 0.01$). Concentrations of PPP in sun-cured SL responded cubically ($P < 0.01$) as the growing season advanced; PPP was least during June and October and peaked during July and August. In contrast, PPP in fresh SL increased quadratically ($P < 0.01$) over time, indicating that significant concentrations of PPP remained in SL late into the growing season. Concentration of CT and PPP in SL decreased dramatically during drying and storage. These data may explain why sharp avoidance of SL by grazing livestock is not generally observed when SL is fed in the form of sun-cured hay. Understanding how drying and plant growth stage influence tannins in SL could lead to more effective research models for the study of SL intake by ruminants.

Key Words: condensed tannin, noxious weed, sericea lespedeza

15 Effects of gestational dietary metabolizable protein level and dry matter intake on subsequent production traits in primiparous heifers. B. M. Nichols^{*1}, T. J. McDonald¹, M. M. Harbac¹, A. J. Roberts², and J. A. Paterson¹, ¹Department of Animal and Range Sciences, Montana State University, Bozeman, ²USDA-ARS, Fort Keogh Livestock and Range Research Laboratory, Miles City, MT.

The objective of this experiment was to determine if feeding 2 levels of dietary metabolizable protein (102% vs. 119% of NRC requirements) and biological variation in feed intake during the second and third trimesters of gestation influenced subsequent production traits in primiparous heifers. Two-yr-old Angus and Simmental \times Angus heifers ($n = 120$, initial BW = 448 ± 36 kg) had individual DMI determined using a GrowSafe feeding system. Dietary treatments were based on approximately 85% grass hay and 15% supplement. Supplements contained whole soybeans plus corn (102% MP) or dried distillers grains plus soybean meal (119% MP) and each supplement was assigned to 2 pens. Heifers were randomly assigned to one of 3 periods (P; 40 heifers/P) followed by random assignment to one of 4 pens (10 heifers/pen). Diets were fed at approximately $10.3 \text{ kg DM} \cdot \text{heifer}^{-1} \cdot \text{d}^{-1}$. After 35 d of intake measurement, heifers were placed into adjacent pens and fed their diets for an additional 50 (P1 and 2) or 82 d (P3). The next 40 heifers (P2) were placed in the facility and DMI was again determined over 35 d. Upon completion of the feeding trial, heifers were returned to the ranch, managed as a single group, and production data were measured. Level of dietary MP had no effect ($P > 0.17$) on calf birth weight, adjusted 205 d weight, ADG, age at weaning, cow BW at calving, proportion of cows cycling at bull turnout, or proportion of cows which conceived. Dry matter intake per unit of $\text{BW}^{0.75}$ (range = $0.057 - 0.187 \text{ kg/kg}$) did not affect ($P > 0.17$) any of the variables measured. Under the conditions of this study, feeding MP in excess of NRC recommendations during mid- to late-gestation did not enhance subsequent heifer productivity. Heifers that consumed less $\text{DM/kg BW}^{0.75}$ produced similarly to heifers that consumed more $\text{DM/kg BW}^{0.75}$.

Key Words: metabolizable protein, dry matter intake

16 Sampling bias when estimating adipocyte cellularity. G. D. Cruz^{*1}, J. A. Oliveira², T. R. Famula¹, and J. G. Fadel¹, ¹University of California, Davis, ²Universidade Federal de Goiás, Goiânia, Goiás, Brazil.

The objective of this study is to determine if a random adipose sample would represent the overall cellularity mean within the *Longissimus dorsi* at the 12th rib. Marbling is a major factor in the determination of beef quality grades and is evaluated by appraisal of the *Longissimus dorsi* at the 12–13th rib interface in the United States. Thus, a goal is to increase marbling without negatively affecting carcass characteristics. A common measurement of the development and distribution of adipocytes is through cellularity, which involves measurements of size and number of adipocytes. Current estimates rely on one sample obtained from the muscle. To evaluate sampling bias, one muscle (2.54cm thick) was divided horizontally into halves of 1.22cm and each half was vertically divided in approximately 10 strips of various lengths for a total of 20 strips. These 20 strips were placed next to each other and 10 were selected by choosing every other one. These strips were evenly divided horizontally into a total of 89 samples. Twenty-five milligrams of marbling fat were dissected from each sample and osmium tetroxide technique was applied to estimate adipocyte cellularity. A random number generator was used to choose 5 samples to represent the muscle. The mean diameters of the samples were 72.4, 90.7, 77.0, 93.4, and 94.2 μm and the overall mean diameter was 81.6 μm . The mean number of cells for each sample was 2.73, 6.36, 1.38, 5.41, and 1.40 $\text{cells/g} \times 10^{-5}$ and the overall mean number was 2.59 $\text{cells/g} \times 10^{-5}$. The mean diameter of each of the 5 samples was different ($P < 0.01$) from the overall mean. Also, 3 of the 5 samples were different ($P < 0.01$) from the overall mean number of cells. In conclusion, sampling bias is the major source of variation when estimating adipocyte size and number. A sampling technique should be developed to reduce sampling bias and increase the precision when estimating adipocyte cellularity. Currently our laboratory is developing such technique.

Key Words: adipocyte cellularity, sampling bias, beef cattle

17 Effect of forage energy intake and supplementation on marbling deposition in growing beef cattle. E. D. Sharman,^{*} P. A. Lancaster, G. G. Hilton, C. R. Krehbiel, and G. W. Horn, Oklahoma Agricultural Experiment Station, Stillwater.

Glucose is the primary carbon source for fatty acid synthesis in intramuscular fat, whereas, acetate is primarily utilized by subcutaneous fat. Our objective was to examine the effect of forage energy intake and type of fermentation on marbling deposition by stocker cattle grazing dormant native range (DNR) or winter wheat pasture (WP). Angus steer calves ($n = 68$; 258 ± 29 kg) were used in a completely randomized design comparing 4 winter grazing treatments: (1) control, $1.02 \text{ kg} \cdot \text{hd}^{-1} \cdot \text{d}^{-1}$ of a 40% CP supplement to meet their DIP requirement while grazing DNR; (2) control plus corn-based supplement at 1% BW while grazing DNR; (3) WP at a high stocking rate (3.2 steers/ha) to achieve a low rate of BW gain; and (4) WP at a low stocking rate (2.2 steers/ha) to achieve a high rate of BW gain. Supplements were fed individually 5 d/wk during the 138-d winter grazing phase. Following winter grazing, 3 steers per treatment were randomly selected for intermediate harvest. The remaining wheat pasture steers were transitioned to the finishing phase, while the DNR treatments remained on summer pasture for 115 d before finishing. Steers were fed to a predicted backfat end point of 1.27 cm. During winter grazing, ADG was 0.19, 0.52, 0.68, and $1.37 \pm 0.03 \text{ kg/d}$ ($P < 0.01$) for treatments 1–4, respectively. Steers that grazed WP had heavier HCW and larger REA ($P < 0.01$) at intermediate harvest than steers supplemented on DNR. Backfat was 0.03, 0.10, 0.17, and

0.85 ± 0.07 cm ($P < 0.01$) and marbling scores were 180, 217, 280, and 340 ± 11.67 ($P < 0.01$) for treatments 1–4, respectively. At harvest after finishing, treatment 3 had a thicker backfat and smaller REA resulting in higher YG ($P < 0.02$) compared with the other treatments. There were no differences in final marbling scores (423, 428, 427, and 425 ± 14.92; $P = 0.99$, respectively). These data indicate that growing programs differing in forage energy intake and type of fermentation can influence marbling deposition at the end of winter grazing; however, final marbling scores may not be affected when cattle are fed to a common fat end point.

Key Words: growing beef cattle, forage energy intake, marbling deposition

18 Grazing patterns of Angus, Brangus and Brahman cows in the Chihuahuan Desert. M. L. Russell,* D. W. Bailey, M. G. Thomas, B. K. Witmore, and C. C. Bailey, *New Mexico State University, Las Cruces.*

In extensive pastures, forage utilization may decrease due to limited water sources. However, adapted breeds of cattle may facilitate an improvement in grazing distribution by utilizing distant portions of extensive pastures. A 2-yr study was conducted to evaluate grazing distribution and quality of diet for Angus, Brangus and Brahman cows in the Chihuahuan Desert during 3 seasons (winter, early summer and late summer) using 3 pastures varying in terrain. Cows were tracked with GPS technologies every 10 min for 10- to 14-d periods in each pasture (3 periods per season). Pooled data from 7 cows of each breed were evaluated in 2008 utilizing a Latin square design with breed as the treatment and period and pasture as blocking factors ($n = 9$). Breeds were kept together during 2009 and evaluated for 10 to 14 d in each of 3 pastures during each season using breed and pasture as fixed effects. When cows were rotated among pastures, fecal samples were collected and analyzed using near infrared spectroscopy (NIRS) to estimate diet quality. In 2008, CP content of diets was similar ($P > 0.31$) among breeds during all seasons. Brahman cows regularly traveled greater distances per day than Angus or Brangus cows during early and late summer seasons in 2008 and 2009 ($P < 0.05$). Brahman cows traveled 12.4 ± 0.6 km/d while Angus and Brangus traveled 7.2 ± 0.6 and 8.3 ± 0.6 km/d, respectively, during late summer 2009. In contrast, average distance from water was similar ($P > 0.59$) among breeds during both 2008 and 2009, which suggests that distribution patterns were similar. Diurnal movement patterns sometimes differed among breeds. In late summer 2009, Brahman cows (1.81 ± 0.11) made more ($P = 0.03$) trips to water each day than Angus (1.15 ± 0.11) or Brangus (1.36 ± 0.11); however, during the winter and early summer in 2008 and 2009, trips to water each day were similar ($P > 0.48$) among breeds. Spatial movement patterns of Brahmans appeared to differ from Angus and Brangus, however, no clear advantage in grazing distribution was observed for any breed.

Key Words: breed, distribution, telemetry

19 Arginine supplementation does not alter nitrogen metabolism of beef steers during a lipopolysaccharide challenge. B. H. Carter*¹, C. A. Löest¹, G. G. Gilliam¹, B. C. Graham¹, J. A. Carroll², C. T. Collier², and D. M. Hallford¹, ¹*New Mexico State University, Las Cruces*, ²*USDA ARS, Lubbock, TX.*

Demand for Arg is reported to increase during immune challenges. This study evaluated effects of lipopolysaccharide (LPS) and abomasal Arg infusion on N metabolism and immune response of 20 ruminally cannulated steers (369 ± 46 kg BW) in a randomized block design. Each block consisted of a 14-d adaptation, 1-d blood collection, and 5-d fecal

and urine collection. Steers were fed a diet (12.9% CP, 0.99 Mcal/kg NEg) at 1.5% BW. Treatments (2 × 2 factorial) were AA solutions with no Arg (-ARG) or 10 g/d Arg (+ARG), and sterile saline with no LPS (-LPS) or 1 µg LPS (+LPS; *E. coli* 055:B5) per kg BW. The AA solutions were abomasally infused (720 mL/d) from d 7 to 20; LPS solutions (100 mL) were intravenously infused (1 mL/min) on d 15. Rectal temperature (RT) and blood samples were collected 0, 2, 4, 8, 12, and 24 h after LPS infusion on d 15. No LPS × Arg × h or LPS × Arg interactions occurred ($P > 0.24$). Cortisol, IL-6, and RT were greater (LPS × h, $P < 0.01$) for +LPS vs -LPS at 2, 4 (peak), 8 and 12 h (cortisol, IL-6). Tumor necrosis factor- α was greater at 2 h, and haptoglobin was greater at 24 h in +LPS vs -LPS steers (LPS × h, $P < 0.01$). Plasma Ala was greater (LPS × h, $P = 0.04$) for +LPS vs -LPS at 2, 12, and 24 h. Plasma Met, Leu, Val, Gln, and Orn of +LPS vs -LPS steers were greater (Met, Leu) or not different (Val, Gln, Orn) at 0 h, not different at 2 and 4 h, lower at 8 (all) and 12 h (Met, Val, Gln, Orn), and either not different (Met, Val, Orn) or greater (Leu, Gln) at 24 h (LPS × h, $P < 0.01$). Plasma Thr, Ser, Asp, Asn, and Glu were lower (LPS × h, $P \leq 0.02$) for +LPS vs -LPS at 2 (Asn), 4, 8, 12, and 24 h (Thr, Ser, Asp, Glu). Plasma Ile and Pro were lower (LPS × h, $P < 0.01$) for +LPS vs -LPS at 4, 8, and 12 h (Ile). Plasma Lys, Tyr, and Trp were lower ($P < 0.05$) for +LPS vs -LPS, and plasma Ala, Pro, and Orn were greater ($P < 0.05$) for +ARG vs -ARG. The +LPS vs -LPS steers tended to have greater ($P = 0.13$) urinary N excretion and lower ($P = 0.11$) N retention, and steers infused with Arg had greater ($P < 0.01$) digested N and tended to have greater ($P = 0.15$) N retention. Abomasal infusion of Arg does not alter the effects of LPS on N metabolism.

Key Words: arginine, lipopolysaccharide, steer

20 Calcium and phosphorus metabolism in finishing steers supplemented with vitamin D₃. J. S. Schutz*¹, M. R. Genho², J. A. Scanga³, K. E. Belk¹, G. C. Smith¹, and T. E. Engle¹, ¹*Colorado State University, Fort Collins*, ²*Ascendant Partners, Inc., Greenwood Village, CO*, ³*Elanco Animal Health, Greenfield, IN.*

Twelve Angus steers (435 kg ± 5.01) were used to determine the effect of high dietary vitamin D₃ (Vit D₃) on Ca and P metabolism in feedlot cattle. Steers were randomly assigned to one of 2 treatments: 1) 0.5 × 10⁶ IU of Vit D₃ · hd⁻¹ · d⁻¹ (0.5 Vit D₃) or 2) 5.0 × 10⁶ IU of Vit D₃ · hd⁻¹ · d⁻¹ (5.0 Vit D₃) for 8 consecutive days. Steers were maintained on a basal ration for 7 d, followed by 8 d of Vit D₃ supplementation and then 5 d of basal ration. Vitamin D₃ was administered via a premix carrier immediately before feeding the basal diet to assure complete consumption of Vit D₃. Individual daily DMI, 24-h urine volume and fecal excretion were recorded and sub-sampled daily for subsequent Ca and P apparent absorption and retention determination. Jugular blood samples were obtained before initiation of Vit D₃ supplementation, at the end of Vit D₃ supplementation, and 5 d following Vit D₃ supplementation. Vitamin D₃ supplementation increased ($P < 0.05$) serum concentrations of 25-OH₂-Vit D₃ in both treatments. Steers supplemented with 5.0 Vit D₃ had greater ($P < 0.05$) serum concentrations of 25-OH₂-Vit D₃ than 0.5 Vit D₃ supplemented steers. Serum Ca concentrations were higher in steers supplemented with 5.0 Vit D₃ compared with 0.5 Vit D₃ supplemented steers. Relative to baseline measurements for each treatment, apparent absorption and retention of Ca were reduced ($P < 0.05$) in steers supplemented with 5.0 Vit D₃ but not altered in steers supplemented with 0.5 Vit D₃. Apparent absorption and retention of dietary P were similar for both treatments. Daily urine excretion increased ($P < 0.05$) from the pre-supplementation period to the end of the Vit D₃ supplementation period and remained greater ($P < 0.05$) throughout the subsequent 5 d non-Vit D₃ supplementation period relative to baseline excretion volumes in

5.0 Vit D₃ supplemented steers. Supplementation of feedlot steers with 5.0 million IU of Vit D₃·hd⁻¹·d⁻¹ increased serum Ca concentrations, decreased Ca absorption, and decreased retention of Ca.

Key Words: vitamin D, calcium, phosphorus

21 Genetic and environmental influences on distribution patterns of beef cattle grazing foothill rangeland. D. W. Bailey¹, S. Marta^{*1}, D. Jensen², D. L. Boss², and M. G. Thomas¹, ¹New Mexico State University, Las Cruces, ²Montana State University, Havre.

A study was conducted in foothill rangelands of northern Montana to determine the relative effects of genotype and environment (or early learning) on grazing distribution. Based on 5 years of observations, 5 of 180 Hereford and Tarentaise crossed cows that used the highest and steepest terrain (hill climbers) and 5 cows that used the most gentle terrain near water (bottom dwellers) were used as donors for embryo transfer. A single AI sire was used in these matings. Crossbred recipient cows were classified as hill climbers (HC) and bottom dwellers (BD) based on 4 years of observation from a separate herd of 98 cows. This resulted in 2x2 factorial study with donor and recipient as the 2 factors and HC and BD as the 2 levels within each factor. A total of 28 of these cows were observed in late summer of 2009 when they were mature (4 to 6 years of age). Horseback riders recorded positions of cows during the early morning when they were grazing for 10 d during the 6 weeks cows were in the 336 ha study pasture. Elevation in the pasture ranged from 1184 to 1398 m and the average slope was 34%. Horizontal distance to water, elevation, and slope of the recorded positions of each cow were averaged together resulting in one value for each trait for each cow. Donor (genotype), recipient (environment) and the donor*recipient interaction were used as fixed effects in the statistical analyses. Distance from water and slope use were not affected by donors, recipients or the donor*recipient interaction ($P > 0.20$). Daughters of HC donors (1314 ± 7 m) used higher elevations ($P = 0.04$) than those from BD (1290 ± 8 m), and cows raised by HC recipients (1315 ± 7 m) also used higher elevations ($P = 0.04$) than cows from BD recipients (1290 ± 8 m). Cattle use of higher elevations in foothill rangeland appears to be influenced to at least some degree by both genetic (donor dam -daughter relationships) and environmental factors such as early learning (recipient dam -daughter relationships).

Key Words: genotype, early learning, behavior

22 *Propionibacterium acidipropionici* P169 and glucogenic precursors to improve rumen parameters associated with low quality forage. P. H. Sanchez, * L. Tracey, J. Browne-Silva, and S. L. Lodge-Ivey, New Mexico State University, Las Cruces.

Cattle grazing dormant western rangelands tend to have a high ruminal acetate to propionate ratio (A:P) and may have low tissue clearance of acetate. Two studies were conducted to evaluate the effects of *P. acidipropionici*, P169 (P169) on VFA production, forage digestibility, and rumen bacterial ecology. In Exp. 1, in vitro effect of P169 on IVDMD and VFA production was evaluated in a 2 × 2 factorial arrangement of treatments. Factors were substrate (dormant warm-season grass extrusa or 50:50 Sudan:corn, DM basis) and P169 (with or without). In Exp. 2, 12 2-yr old, pregnant Brangus heifers (BW = 416 ± 85 kg) were assigned to 1 of 3 treatment (n = 4). All cattle were fed a basal ration consisting Old World Blue stem hay at 1.5% BW 10 d before initiation of treatment and for the duration of the experiment. Treatments were 1) protein supplement (36% CP, 35% UIP of CP, DM basis, fed at 454 g/hd per d; CON), 2) CON plus P169 (6 × 10¹⁰ cfu/hd, twice per d; P169), 3) calcium-propionate supplement fed at 454 g/hd per d (36% CP, 53% UIP

of CP + 80 g calcium propionate; PROP). Ruminal fluid was collected and analyzed for VFA, ammonia, pH and community DNA was extracted for denaturing gradient gel electrophoresis (DGGE). Glucogenic potential of treatment was evaluated with an acetate tolerance test on d 49. In Exp. 1, IVDMD, total VFA, acetate, propionate, and A:P increased ($P < 0.001$) in both extrusa and 50:50 with P169 addition. In Exp. 2, the only effect of P169 on rumen parameters was a 4.3% increase in propionate ($P < 0.02$) over CON. Calcium-propionate supplement increased propionate and decreased A:P by 7.8% and 5.9% respectively ($P < 0.004$) over CON. Similarity of bacterial populations between treatments was evaluated with construction of a DGGE dendrogram using the Dice coefficient and samples were 73.9 ± 6.38% similar. Acetate half-life did not differ by treatment ($P = 0.49$). These data indicate that addition of propionate-producing bacteria to low quality forage diets could be as beneficial as supplementing with a propionic salt.

Key Words: cattle, propionate, *Propionibacterium acidipropionici*

23 Effects of supplemental docosahexaenoic acid to ewes on lamb production, immunocompetence, serum metabolites, and thermogenesis. J. I. Keithly, * R. W. Kott, J. G. Berardinelli, S. Moreaux, and P. G. Hatfield, Montana State University, Bozeman.

Eighty twin-bearing Targhee ewes (ages 2 to 5 yr; 68.5 ± 3 kg) were stratified by age and assigned randomly to 1 of 2 supplemental treatments to determine the effects of feeding algae containing docosahexaenoic acid (DHA) to ewes during late gestation and early lactation on lamb growth (from birth to 38 d), passive immunity (anti-Parainfluenza Type 3 titers), serum metabolites, and thermogenesis. Treatment supplements were formulated to be isocaloric and isonitrogenous, and when fed at the rate of 0.9 kg daily with a 10% CP and 58.1% TDN hay met the CP and TDN requirements of a 70-kg twin-bearing ewe during late gestation. Supplement treatments were: 1) 12 g/ewe daily of DHA Gold (Advanced Bionutrition Corporation, Columbia, MD), in the form of algal biomass (ALGAE), and 2) no DHA (CONTROL). Diets were individually fed (40 ewes/treatment) daily during the last 30 d of gestation and pen fed (6 pens/treatment, and 6 or 7 ewes/pen) during the first 38 d of lactation. One hour after lambing, twin-born lambs were weighed, bled via jugular puncture, and placed in a 0°C dry cold chamber for 30 min. Lamb rectal temperature was recorded every 1 min. After cold exposure, lambs were removed from the cold chamber, bled via jugular puncture, and returned to their dam. Lambs were weighed and bled via jugular puncture on the final day of the trial (38 d of age ± 7 d). Lamb sera were assayed for glucose, NEFA, cortisol, and anti-Parainfluenza Type 3 (PI₃) titers. There was a treatment by time interaction ($P < 0.01$) for lamb rectal temperature. Lambs born to ALGAE ewes had higher ($P = 0.09$) rectal temperatures at 0 min compared with CONTROL lambs, but rectal temperature did not differ ($P ≥ 0.11$) at any other time during cold exposure. Glucose, cortisol, NEFA, anti-PI₃ titers, and birth weights did not differ between treatments. Lamb 38-d BW was greater ($P = 0.03$) in lambs born to CONTROL ewes than in lambs born to ALGAE ewes. Supplementation of DHA during late gestation and early lactation did not appear to benefit lamb production, or factors that may impact production.

Key Words: docosahexaenoic acid, lamb production, thermogenesis

24 Sustainability implications of feedlot management practices. K. L. Coopridge, * F. M. Mitloehner, and A. L. Van Eenennaam, University of California, Davis.

There is an increased consumer demand for animal products that have been raised sustainably. This term has many definitions, but generally

refers to some balance of environmental, social, and economic goals. The use of biotechnologies that increase units of output (e.g., pounds of meat) with the same or fewer inputs should be included in sustainability assessments. The objective of this project was to quantify the inputs (days on feed, kg feed fed and refused, ADG, health treatments) and outputs (carcass measurements, greenhouse gas emissions) associated with 2 feedlot cattle management regimens: Never Ever 3 (NE3) and conventional cattle (CON). The former treatment group received no feed additives or implants, whereas the latter were implanted with Synovex Choice (Fort Dodge) on d 1 and d 70, and were additionally fed Elanco's Rumensin (330 mg/head/day), Tylan (90 mg/head/day), and for the 29 d before shipping Optaflexx β -agonist (254 mg/head/day). Angus-cross steers were stratified by BW ($n = 104$; $337 \text{ kg} \pm 17$) and randomly assigned to 4 pens per treatment group. Amount of feed fed per pen and refusals were recorded daily. Animals were shipped on a constant average pen weight basis (Target 590 kg; actual $596 \text{ kg} \pm 32 \text{ BW}$). The CON cattle had higher ADG (1.81 vs. 1.35 kg, $P < 0.01$), and were on feed fewer days (146 vs. 188 d, $P < 0.01$) than NE3. No significant differences were observed in HCW or dressing percentage between groups ($P > 0.05$), however CON carcasses had larger ribeyes ($87 \text{ vs. } 80 \text{ cm}^2$, $P < 0.01$), lower USDA marbling score (5.4 vs. 6.2, $P < 0.01$), backfat thickness (1.64 vs. 1.84 cm, $P < 0.05$) and yield grade (3.38 vs. 3.95, $P < 0.01$) as compared with NE3. Overall, CON cattle consumed 393 kg less feed in the feedlot (1250 vs. 1643 kg, $P < 0.05$). Although additives resulted in additional costs in CON steers, cost of feed per kg of gain was significantly lower ($\$1.12 \text{ vs. } \$1.35/\text{kg}$, $P < 0.05$) relative to NE3. The use of implants and feed additives reduced feed inputs and production resources required to produce a fixed amount of output, with resultant environmental and economic sustainability advantages.

Key Words: feedlot, sustainability, biotechnology

25 Effect of ram exposure on temporal patterns of progesterone and metabolic hormones concentrations in 18-mo-old virgin Targhee ewes during the transition into the breeding season. R. B. McCosh^{*1}, E. M. Berry¹, M. E. Wehrman¹, R. R. Redden¹, R. W. Kott¹, D. Hallford², and J. G. Berardinelli¹, ¹Montana State University, Bozeman, ²New Mexico State University, Las Cruces.

The objective was to determine if ram exposure during the transition into the breeding season altered progesterone (P4), cortisol, triiodothyronine (T3), thyroxine (T4), T3:T4 ratios, prolactin (PRL) or IGF-1 concentrations in 18-mo-old Targhee ewes. Anestrous ewes were stratified by residual feed intake (RFI) score (efficient; $n = 12$); middle; $n = 12$; inefficient; $n = 12$) and assigned randomly to be exposed to rams (RE; $n = 18$) or wethers (NE; $n = 18$). Ewes within exposure type were assigned to one of 2 pens (1 male/9 ewes/pen); with 33 m separation between RE and NE pens. Blood samples were collected from each ewe by jugular venipuncture every other day for 20 d, beginning on the first d of exposure. Samples were assayed for P4, cortisol, T3, T4, PRL, and IGF-1. Resumption of luteal activity began earlier ($P < 0.05$) in RE than in NE ewes. There were no differences in patterns of cortisol, T3 or IGF-1 concentrations, or T3:T4 ratios between RE and NE ewes or among ewes with efficient, middle, or inefficient RFI scores. There was a treatment by day interaction ($P < 0.05$) for T4 and PRL concentrations. Concentrations of T4 in RE ewes decreased less rapidly and over a longer interval before increasing by the end of the sampling period than those in NE ewes. Concentrations of PRL were greater in RE than in NE ewes 4 d after exposure but decreased over the next 12 d; whereas, PRL decreased in NE ewes during the first 6 d then increased over the next 14 d. There was an exposure type by RFI score interaction ($P < 0.05$)

for BW change. Change in BW did not differ among NE and RE ewes with medium or inefficient RFI scores. However, RE ewe with efficient RFI scores showed a greater increase in BW over the 20-d experiment than NE ewes with efficient RFI scores. Exposing 18-mo-old ewes to rams accelerated resumption of luteal activity and altered T4 and PRL concentrations during the transition into the breeding season. Furthermore, the ram effect appears to alter BW change in ewes with efficient RFI scores differently than in ewes of lower RFI scores.

Key Words: ram biostimulation, seasonal anestrus, metabolic hormones

26 Conjugated linoleic acid decreases prostaglandin synthesis in bovine luteal cells. K. C. P. May,^{*} G. Bobe, C. J. Mueller, and M. J. Cannon, Oregon State University, Corvallis.

Feeding conjugated linoleic acids (CLA) improves reproductive performance in dairy cows; however, the molecular mechanisms by which CLA improves reproduction are not well understood. Therefore, we evaluated whether the CLA isomers, *trans*-10, *cis*-12 CLA and *cis*-9, *trans*-11 CLA altered synthesis of steroidogenic hormones in bovine luteal cells by measuring concentrations of progesterone, PGE₂, and PGF_{2 α} in conditioned medium and expression of genes involved in their synthesis. Confluent luteal cells from each of 4 cows were cultured in 0 μM (control) or 0.1 μM solutions of *trans*-10, *cis*-12 CLA and *cis*-9, *trans*-11 CLA in varying ratios (1:0, 0:1, 1:1, 2:1, 1:2, 5:1, 1:5, 9:1, or 1:9) for 48 h in the presence and absence of 1 μM of the adenylate cyclase activator forskolin. Independent of CLA isomer and ratio, CLA decreased, compared with control, hormone concentrations of prostaglandin F_{2 α} ($62.6 \pm 10.5 \text{ vs. } 50.4 \pm 9.9 \text{ pg/mL}$; $P = 0.003$) and, in the absence of forskolin, prostaglandin E₂ ($61.2 \pm 11.3 \text{ vs. } 36.1 \pm 10.1 \text{ pg/mL}$; $P < 0.001$) in cultured luteal cells, while no effect was observed for progesterone ($P = 0.94$). Compared with control, CLA decreased relative levels of COX-2 mRNA, a rate limiting enzyme in prostaglandin synthesis, by 1.7 fold ($P < 0.001$) and 3 β -hydroxysteroid dehydrogenase mRNA, a rate limiting enzyme in progesterone synthesis, by 1.4 fold ($P = 0.008$). Relative levels of PGE synthase and PGE₂ 9-keto-reductase mRNA, both involved in prostaglandin synthesis, and steroid acute regulatory protein and cytochrome P450 side chain cleavage mRNA, both involved in progesterone synthesis, were not significantly altered by CLA. In conclusion, a potential mechanism by which *trans*-10, *cis*-12 CLA and *cis*-9, *trans*-11 CLA may improve reproductive performance in dairy cows, is by suppressing PGF_{2 α} synthesis in luteal cells through attenuating COX-2 gene expression.

Key Words: cattle, corpus luteum, progesterone

27 Camelina meal and crude glycerin as feed supplements for developing replacement beef heifers. P. Moriel,^{*} B. I. Cappelozza, V. Nayigihugu, K. M. Cammack, and B. W. Hess, University of Wyoming, Laramie.

Two hundred and 4 ($n = 99$, yr 1; $n = 105$, yr 2) Angus \times Gelbvieh rotationally crossbred heifers were used in a 2-yr randomized complete block designed (RCBD) experiment to determine the effect of feeding camelina biodiesel co-products (meal and crude glycerin) on serum concentrations of thyroid hormones and glucose, as well as on growth and reproductive performance. Heifers were stratified by BW ($297 \pm 5.8 \text{ kg}$) and randomly allocated to a pen that received bromegrass hay plus 1 of 3 supplements (12.6% CP): control (50% ground corn and 50% soybean meal, as-fed); camelina meal (mechanically extracted); glycerin (50% soybean meal, 33% ground corn, 15% crude glycerin, 2% corn gluten meal; as-fed) for a 60-d period. Preprandial blood samples

were collected via the jugular at d 0, 30 and 60 of the experimental feeding period. On d 60, heifers were synchronized for estrus using a 2-shot PGF2 α protocol; any heifer exhibiting estrus was bred via AI 12 h after standing heat. Heifers not exhibiting estrus were given GnRH and bred by AI on d 74. Data were analyzed as a RCBD using the MIXED procedure of SAS with pen as a random effect for BW and reproduction traits; serum parameters were analyzed as repeated measures. Dietary treatment \times sampling period interactions were not detected ($P = 0.17$ to 0.87). Dietary treatment did not affect serum T₄ ($P = 0.96$), glucose ($P = 0.59$) or BW at d 30 or 60 ($P \geq 0.40$), but increased ($P = 0.05$) T₃ in heifers fed camelina meal. Additionally, dietary treatment did not affect the percentage of heifers detected in estrus before timed AI ($P = 0.82$), first service conception rates of those heifers detected in estrus ($P = 0.87$), conception rates to timed AI ($P = 0.19$), or overall first conception rates ($P = 0.65$). Heifers fed camelina co-products maintained growth and reproductive performance comparable to heifers fed the control supplement. Therefore, camelina co-products can replace conventional corn-soybean meal supplements.

Key Words: beef heifers, supplementation, biodiesel co-products

28 Use of a portable near infrared spectrophotometer to predict nutrient composition of feces from Holstein cattle fed high-concentrate diets. J. D. Allen,* D. R. Tolleson, L. W. Hall, C. D. Burrows, G. Xie, and G. C. Duff, *University of Arizona, Tucson.*

Our objective was to evaluate the application of a chute-side near infrared spectrophotometer (NIRS) analysis to predict nutrient composition of feces from Holstein cattle. Growing Holstein cattle (42 steers and 2 freemartin heifers; average initial BW = 220 kg) were fed either 86 or 90% steam-flaked corn-based concentrate diets (3 pens/diet with 7 to 8 animals/pen). Fecal samples were collected in plastic bags and scanned within 2 h after collection using an ASD Field Spec NIRS unit (Boulder, CO). Spectra were collected under ambient conditions using a contact probe. Samples were then dried at 60°C, ground in a Wiley mill to pass a 1 mm screen and analyzed for DM, CP, NDF and ADF. Calibrations were developed using samples collected on d 0 and 28 with log 1/R spectra in the 1,100 to 2,400 nm range. Partial least squares (PLS) regression in SAS was used to develop calibrations. Cross validation was employed to determine the number of PLS factors to use. Simple regression was used to evaluate the relationship between observed and predicted constituent values. Although regression values were moderate for predicting CP ($R^2 = 0.88$) and fair for DM ($R^2 = 0.68$) and NDF ($R^2 = 0.62$), prediction regression values for ADF were statistically significant ($P < 0.01$) but not predictive ($R^2 = 0.34$). Our data indicate that while our calibrations were variably successful, validations were mostly unsuccessful ($R^2 < 0.4$). Lack of validation success is most likely due to small sample number and limited range of values. However, this project has illustrated a relationship between NIR spectra and the observed laboratory values for these constituents, and that the use of a portable NIRS on-site may improve the nutritional management of a commercial feedlot.

Key Words: NIRS, Holstein, nutrient composition

29 Effects of implant type and protein source on growth performance of steers grazing summer pasture. C. P. McMurphy,* E. D. Sharman, D. A. Cox, G. W. Horn, and D. L. Lalman, *Oklahoma State University, Stillwater.*

Implants consistently increase performance 10 to 15% in grazing cattle and supplemental protein is necessary in late summer when forage is maturing and rumen ammonia-N is first limiting. Therefore,

a split-plot design was used to investigate the effects of implant type and protein source on performance of steers grazing summer pasture. Crossbred steers ($n = 392$; BW = 212 ± 24 kg) were ranked by weight and randomly assigned to 1 of 15 pastures and then randomly allotted to implant treatment, within pasture. Supplement treatments were control (no supplement), dried distillers grains with solubles (DDGS; 33% CP), and cottonseed meal (CSM; 33% CP). Implant treatments were control (no implant), Ralgro and Component TE-G. The grazing season was 126 d with supplementation beginning in late July. Steers were group fed, within pasture, each wk on Monday, Wednesday and Friday at a rate of $0.95 \text{ kg} \cdot \text{steer}^{-1} \cdot \text{feeding}^{-1}$. Data were analyzed using PROC MIXED procedure of SAS where supplement treatment served as the whole-plot and implant treatment served as the sub-plot. Orthogonal contrasts were used to determine the effects of supplementation, supplement type, implantation and implant type. Protein supplementation increased ($P < 0.05$) BW and ADG by 12 and 0.16 kg, respectively. Compared with CSM, DDGS improved ($P < 0.05$) ADG by 0.05 kg resulting in improved supplement efficiency (2.39 vs. 3.49 kg of supplement per kg of additional ADG for DDGS and CSM, respectively). Implantation increased final BW ($P = 0.02$) and improved ADG 8.1% ($P < 0.05$) during the first ~95 d, but implant type had no influence on rate of BW gain during this period. During the final ~31 d of the grazing season there was no difference in ADG for Ralgro and non-implanted steers, while Component TE-G increased ($P < 0.05$) ADG by 0.08 kg. Steer performance was enhanced when supplemental CSM was replaced by DDGS. Furthermore, Component TE-G implants enhanced weight gain further into the grazing season than Ralgro.

Key Words: implants, supplementation, grazing steers

30 The effect of morbidity on feedlot performance and carcass quality in feedlot steers. K. J. Austin*¹, J. L. Seabrook¹, T. E. Engle¹, R. K. Peel¹, C. M. McAllister¹, B. W. Brigham¹, R. M. Enns¹, R. L. Weaver², H. Van Campen¹, G. H. Loneran³, J. L. Salak-Johnson⁴, and C. C. L. Chase⁵, ¹Colorado State University, Fort Collins, ²University of Missouri, Columbia, ³West Texas A & M University, Canyon, ⁴University of Illinois, Urbana, ⁵South Dakota State University, Brookings.

The objective of this project was to examine the effects of morbidity in feedlot cattle on animal performance, carcass quality, and subsequent carcass value. Performance and morbidity data were collected over a 2 year period (year 1 $n = 1551$; year 2 $n = 1319$). Steers were randomly assigned to 9-head pens and fed a commercial feedlot ration for 230 ± 5 d (year 1 and year 2) with an average entry weight of 224 kg or 219 kg for year one or 2, respectively. Body weight and ultrasound measurements of ribeye area (REA), intramuscular fat (IMF) and backfat (BF) were collected at 6day intervals between d0 and d180. Animal performance data in conjunction with yield and quality grade measurements at the time of slaughter were analyzed to determine impacts on performance resulting from feedlot morbidity. Morbidity was defined as behavioral and/or physical abnormalities observed during daily rounds (between 0700 and 0900), severe enough to warrant pharmaceutical treatment and/or isolation pens from designated treatment pens. For year one, morbidity was a source of variation for ultrasound BF and REA measurements ($P < 0.01$, $P = 0.02$, respectively), and resulted in lower final live body weight ($P = 0.01$). For year 2, morbidity was a source of variation for final live body weight and hot carcass weight (HCW) ($P < 0.01$), and calculated yield grade was marginally lower in morbid steers ($P = 0.08$). Feedlot morbidity was a factor in reducing the performance and ultimate carcass yield from the steers in this experiment.

Key Words: carcass characteristics, feedlot performance, morbidity

31 Changes in hepatic gene expression in steers administered high-S water with or without supplemental Mo. K. L. Kessler*¹, K. C. Olson², C. L. Wright², K. J. Austin¹, and K. M. Cammack¹, ¹University of Wyoming, Laramie, ²South Dakota State University, Brookings.

High-S water is associated with reduced performance, poor health, and an increased incidence of polioencephalomalacia (PEM) in ruminant livestock. Changes in expression of immune function and inflammatory response genes have been shown in steers administered high-S water. Our objective was to determine changes in hepatic gene expression in steers administered low-S water or high-S water with or without supplemental Mo. Yearling steers (n = 96) were randomly assigned to a low-S water (LS; 375 mg SO₄/L), high-S water (HS; 2,218 mg SO₄/L), or high-S water plus Mo (HSMO; 2,218 mg SO₄/L; 100 mg Mo/kg DM) treatment for 56 d. Body weights were recorded on d -1, 29, and 57, and liver biopsies were conducted on d 57. Feed intake (as-fed basis) was lower in HSMO steers than HS ($P = 0.018$) and LS ($P = 0.002$) steers. Also, ADG was lower ($P < 0.001$) in HSMO steers than LS and HS steers, with HS steers being intermediate. For real-time RT-PCR

analysis, RNA was extracted from liver tissues of 8 randomly selected steers within each treatment. Genes selected for analysis included *RegI*, *TGFβ1*, *INHβA*, *Iβ2*, *TG2*, and *APP*, all of which were affected by high-S water in a previous study. Relative expression values were tested for treatment differences using the GLM procedure of SAS. Expression of *TG2* tended to be greater in HS steers than LS ($P = 0.08$) and HSMO ($P = 0.06$) steers. However, *TG2* expression was not different between LS and HSMO steers, indicating that Mo prevented the change in *TG2* expression induced by high-S water. Expression of *APP* was lower in HSMO steers than both LS ($P < 0.001$) and HS ($P = 0.04$) steers. No differences in *APP* expression were detected between LS and HS steers, indicating that the downregulation of *APP* in the HSMO steers was due to the Mo treatment, not the high-S water. No other changes in gene expression were observed. Results from this study indicate that hepatic gene expression is altered in response to high-S water and possibly Mo treatment. Further work is needed to determine other genes and metabolic pathways affected by high-S water consumption in ruminant livestock.

Key Words: gene expression, sulfate water, beef cattle